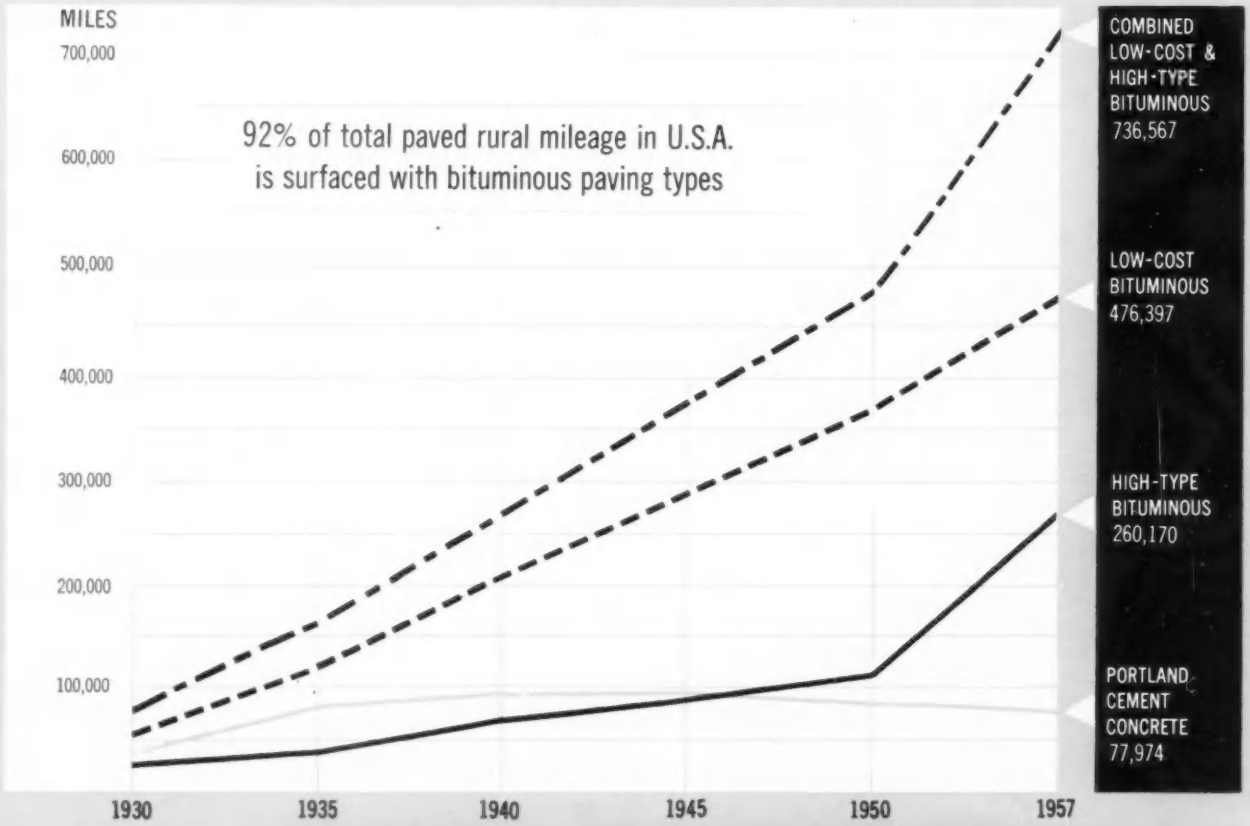
ASPHALT INSTITUTE *Quarterly*

OCTOBER, 1959

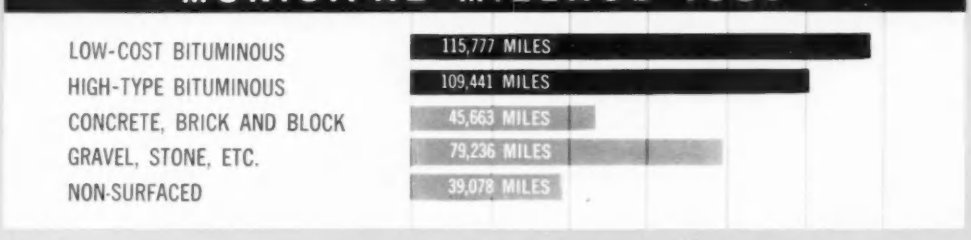
In this issue: ITALIAN PAVING IS ON THE BEAM

EXISTING SURFACED MILEAGE ON RURAL ROADS

BITUMINOUS TYPES AND PORTLAND CEMENT CONCRETE



MUNICIPAL MILEAGE 1957



Sources:
U. S. Bureau of Public Roads; also American Association of State Highway Officals for rural roads on state systems, 1930, 1935, 1940 and 1945

CHARTED BY THE ASPHALT INSTITUTE, OCTOBER 1959

EDITORIAL:

WHAT ABOUT STAGE CONSTRUCTION?

THREE years ago in this space, Mr. Bernard E. Gray, a distinguished engineer, advised that savings approaching $3 billion could be realized by paving the 41,000 miles of Interstate highways with asphalt concrete.

Now, in the aftermath of the Great Fiscal Soul-Searching of 1959, it may be appropriate to suggest again that there is more than one way to skin a cat—or build a road. Certainly, the taxpayers are just a little disillusioned. Maybe it's time for the engineers to be heard again.

As far back as 1951, the same Mr. Gray was keenly aware of the rising interest in a general road overhaul program. At that time he offered a sane and logical plan for rehabilitating the nation's highway system swiftly and economically.

Mr. Gray's plan called for stage construction of projects on new locations—to get more miles of new road built faster with less money. And he urged maximum salvage of existing roads and structures—simply as sound engineering practice. Naturally, this 1951 thinking did not contemplate the Interstate system and ten-cent Federal dollars. It simply recognized the looming road crisis and proposed a realistic way out of a dilemma for the hard-pressed states.

Stage construction, in width and in depth, is earnestly recommended as sound engineering. Also, it is in tune with the pay-as-you-go financing principle advocated by legislators.

For example, there are numerous instances where the present traffic volume doesn't call for a costly four-lane divided highway. A modern dual-lane highway will handle the flow nicely for several years. So, why sink millions into a futuristic facility when these dollars are desperately needed elsewhere? Engineering logic recommends the purchase today of the necessary right-of-way for tomorrow's double-barreled Interstate highway. But only the first of these two roadways need be built. The second roadway can be added as needed—and as funds become available. *This is stage construction in width.*

Similarly, it is sound engineering to construct a pavement in stages. An asphalt base may be constructed, then sealed against the weather and opened to traffic for a year or longer before adding the dense, tough asphalt concrete surface courses. In the intervening period, natural settlement occurs and traffic completes the job of consolidation and base compaction, assuring a superior pavement when the wearing course is laid.

Meanwhile, the motoring public has the use of a new highway, opened much sooner and at less cost—freeing funds for additional construction of the same type elsewhere. *This is stage construction in depth.*

Salvage of existing facilities is another recommended engineering principle largely forgotten in the spending race. Widening and resurfacing of existing primary and secondary pavements frequently will dissolve a congestion problem at a fraction of the cost of relocation. Sometimes partial relocation may be necessary for improved alignment, retaining substantial stretches of the existing road. It is largely a matter of determining the degree of inadequacy of the existing facility and making the necessary corrections.

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Glynn Harvey
Editor

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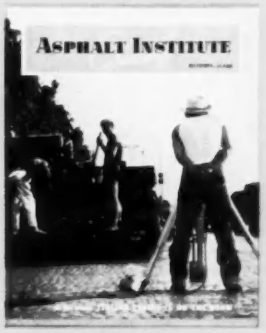
Cover

Cover photo shows interesting Italian paving control device in operation during resurfacing of old brick pavement. A report on the electronic eye, with other pictures, may be found on pages 13 and 14.



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The member companies of the Institute, who have made possible the publication of this magazine, are listed on page 15.

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South Carolina is second only to Texas in miles of Interstate construction placed under contract in spite of commitments of funds and engineering manpower on state's A-B-C system

THE STATE of South Carolina is roaring along on a road-building program that is actually three programs all wrapped up in a single package. While some states are struggling with their Interstate projects to the neglect of their A-B-C system, the Palmetto State is barreling along with both plans—and tackling a modern Farm-to-Market road program to boot.

As the 1959 construction season clatters into the stretch, here's how South Carolina stands in all three phases of its ambitious program:

THE TRIPLE PLAY

1. The Interstate System—With 275 miles under contract, South Carolina is second only to Texas. In addition, the state has 66 bridges built and another 164 contracted for or under construction. Twelve miles of I-road are completed and in service.

"Stretch the dollar as far as it will go"

Although the best possible estimates as to the cost of the Interstate system were made before the program was initiated, we have seen how costs have spiraled by inflation and these estimates have already been exceeded. In the face of this situation, together with the possibility of curtailment in federal aid, it is essential that highway departments give close attention to the matter of economy in operations to stretch the dollar as far as it should go. As highway department administrators charged with the responsibility of engineering and building the roads we must use the most economical means possible in doing the job that has been laid out for us to do.

I have heard suggestions time and again that we should not worry too much about the cost of right-of-way or a particular material or method on Interstate system construction, when the federal government is putting up 90 percent of the money and the states only 10 percent. Well, when I hear such nonsense, I quickly reply that regardless of the 90-10 formula, ALL of the money is, nevertheless, coming from the people, that the federal government has no other source for its revenues. I think we would be nearsighted indeed, in fact outright wasteful, to adopt an attitude that we can use one measure of economy for the Interstate program and another for our regular programs. We can be sure that any such thinking will eventually lead down the road to disaster.

It behooves each of us who has responsibilities in highway administration, engineering and fiscal affairs to exercise sound economic sense by fighting waste and unnecessary costs, regardless of the type of program, project or system.

From the annual President's Address, by Claude R. McMillan, American Association of State Highway Officials, San Francisco, December 1, 1958.

THREE-

2. The A-B-C System—Narrow and obsolete slab pavements are being widened and resurfaced with asphalt concrete at a steady-going rate of about 100 miles a year while existing asphalt-paved roads are being widened and strengthened with asphalt-concrete overlays at a matching pace.

3. Farm-to-Market Roads—Under terms of special legislation implemented by a one-cent-a-gallon levy on motor fuels, the state is paving and incorporating into the state system hundreds of miles of county roads each year. In most instances this involves grading, drainage and earth-type base course with a double surface treatment at an average cost of $13,000 per mile, the first step in a general up-grading of all state roads by stages.

The man behind this high-balling operation is Chief Highway Commissioner Claude R. McMillan, courtly and soft-spoken native of Mullins, a sun-drenched tobacco market over in the Low Country. President of the American Association of State Highway Officials last year, Commissioner McMillan has fashioned a smooth-running road-building machine in the large, new State Highway Department building in Columbia.

METHODICAL APPROACH

Methodically, McMillan and his engineers are going about the construction of South Carolina's 685-mile Interstate network. To date, work has been confined principally to Route I-26 which starts at the North Carolina line and angles down across the state in a southeasterly line past Spartanburg in the northwest and Columbia to Charleston on the coast. The last thirty miles at both extremities of the route are expected to be under contract by the end of 1960.

Meanwhile, some thirty-six miles on Route I-85 have been incorporated into the system by the simple expedient of constructing a second two-lane barrel in Greenville, Cherokee and Spartanburg counties. Route I-85 will slice across the western part of the state, roughly following the present route of U.S. 29, the main artery between Charlotte, North Carolina and Atlanta.

Two other I-roads will form an inverted Y with a juncture near Florence, carrying north-south traffic from the North Carolina line down to Savannah and Augusta, Georgia.

ASPHALT SALVAGE FOR SLABS

On the A-B-C system, South Carolina is salvaging with asphalt paving an extensive network of narrow and worn-out rigid pavements and beefing up older asphalt primary pavements with asphaltic overlays. But the major effort is being made on the state's 17,962 miles of secondary roads. Since the end of World War II, $365 million have been spent on South Carolina's highways, of which $153 million were spent on improving more than 11,000 miles of secondary roads. Today, more than 14,000 miles of these secondary roads are paved, and work is progressing at a rate of about 700 miles a year.

The rehabilitation of old concrete pavements on the state primary system is a major undertaking. In the aftermath of World War II, the state had more than 2,000 miles of these pavements—dangerously narrow, badly eroded by time and traffic, and increasingly costly to maintain. A methodical program of resurfacing has reduced this figure to less than 1,300 miles. Since 1954 a total of 531 miles of obsolete roads have been widened to the full 24 feet or more. Most of this mileage consisted of pavements less than twenty feet wide when the program was launched.

Meanwhile, by making judicious use of stage construction techniques and exploiting locally available aggregates, South Carolina is getting maximum dollar value for every square yard of new construction, wherever possible. And the state is building a system of highways which will continue to grow in load-carrying capacity and mooring pleasure wih minimum inconvenience and expense as changing traffic conditions require.

South Carolina Pushes Triple-Ply Road Program

EE-WAY STRETCH IN DIXIE

BEFORE

Old and narrow pavements are being widened and resurfaced

AFTER

. . . like this stretch of U.S. Route 17 north of Charleston

An embarrassing shortage of suitable road-building aggregates in the state is being overcome by the widespread use of sand-asphalt base, as shown here

South Carolina's inventive engineers even use a base cushion of plant-mix asphalt before resurfacing old slab paving with asphalt concrete overlay

ASPHALT BASE

The formula for better roads in aggregate—shy Palmetto State

FROM the broad sweep of the Capitol steps at Columbia, South Carolina, George Washington stares benignly down the length of Main Street, leaning elegantly on a walking stick which appears to be firmly planted in thin air. The legend in bronze explains that the lower half of the cane was snapped off by a brickbat, hurled by a hooligan soldier during Sherman's occupation of the city in 1864.

This could only happen in Columbia which lies handy to one of the few significant deposits of road metal in the state, an oasis of granite in a desert of sand and silty clay. Elsewhere, Sherman's berserk trooper would have had to order a brickbat by mail from another state, or abandon his wild impulse as futile.

AGGREGATE SHORTAGE

This acute shortage of road-building aggregates has placed a premium on engineering resourcefulness, and South Carolina's highway engineers have responded with enterprise and boldness. Their use of asphalt base is blazing a wide trail for other states where each tick of the clock brings closer the day of aggregate bankruptcy.

South Carolina's mineral cupboard is comparatively bare. No glacier ever reached her, no volcanic eruptions ever disturbed her, and she only drained the ocean out of her hair a millenium or two ago. Save for an occasional outcrop of granite and gneiss, mainly in the craggy northwestern corner, she is a vast sloping coastal plain of sand and silt and clay with a leavening of gravel.

When the end of Word War II signaled the resumption of road-building on a broad scale, South Carolina's highway officials already were disenchanted with the costlier slab pavements that had drained their energies and available funds during the 1930's. They turned to asphalt construction and, driven by the circumstances of aggregate poverty, began to experiment boldly with hot-mix sand-asphalt and asphalt-macadam base.

SAND-ASPHALT BASE USED

The state's use of sand-asphalt base construction on its primary system has attracted considerable attention in other aggregate-shy states. Meanwhile, the success of these pavements encouraged the engineers to experiment with coarser-grade base mixtures with an eye to strengthening their standard macadam base structure.

So, when the Federal Aid Highway Act of 1956 was passed with its heavy accent on the Interstate super-network, South Carolina was ready with another asphalt base design—her standard macadam base specification, modified to make the top five inches of the 12-inch thickness an asphalt plant mix at an additional cost of about sixty cents psy. The design already has proven itself on the state's primary roads where some of these pavements have been in service for five and six years with no evidence of distress or surface deformation.

A typical cross-section will show four to six inches of selected field soil subbase to which is mixed 400 pounds per square yard of No. 2-A stone and crushed stone screenings to give "body" to the field soil which, for the most part, has a low bearing value. On this prepared subbase are placed seven inches of crusher run macadam base, followed by five inches of asphalt base, consisting of the same crusher run gradation (100 percent passing the 2½" screen) plant-mixed with 3½-to-four percent of 85-100 penetration asphalt.

A 250-pound binder and 150-pound asphalt concrete surface course complete the 20-inch pavement structure.

INTERSTATE DESIGN

This is the pavement design which South Carolina proposes to use on most of the 685 miles of Interstate routes in the Palmetto State. Moreover, Construction Engineer J. D. McMahan expects that there will be some sand-asphalt base built on the Interstate system before the 13-year program winds up. Present sand-asphalt base design calls for ten inches of hot sand-asphalt mix base (or road mix on the secondary system), laid in three compacted courses of approximately three inches each and meeting a Marshall stability requirement of 250 pounds. This base is then topped off with 150-pound binder and 100-pound asphalt concrete surface course.

"If we go to sand-asphalt base on the Interstate system, of course, we'd have to heavy up the design," McMahan explains.

Meanwhile, South Carolina's inventive design engineers have come up with a new type of asphalt base, used in the resurfacing of the state's old slab pavements. It consists of four inches of plant mix (100 percent passing the 1½" screen with 4-to-4½ percent of 85-100 penetration asphalt), laid on the old slab foundation as a cushion for the asphalt concrete overlay. The Palmetto State still has some 1,200 miles of obsolete concrete pavements, being widened and resurfaced with asphalt paving at a rate of about 100 miles a year.

Asphalt base construction fits in perfectly with Engineer McMahan's road-building philosophy.

FAVORS STAGE CONSTRUCTION

"There's only one way to build a road, in my opinion," he says. "That's stage construction. Build your base course and let it stand out there for a while under traffic. Let it weather, and settle, then come back and put your surface down."

Asphalt base, of course, provides a smooth temporary riding surface and the additional compaction under prototype traffic searches out any concealed defects in the foundation which can be corrected before the asphalt concrete wearing course is laid. Virtually very paving engineer recognizes the validity of this engineering thesis, but South Carolina's highway engineers have demonstrated the courage of their conviction in this respect.

In a large measure, this boldness is borne out of a determination to overcome the deficiencies of nature, and it all adds up to an excellent highway system in the making.

Hot-mix asphalt base is being used on the Palmetto State I-roads and engineers expect to use sand-asphalt base in some locations

"HIGH, WIDE AND H

COLORADO's newest superhighway is a 9.2-mile artery of heavy-duty asphalt which threads its way through Pueblo, the state's second largest city. And plans have been drafted to extend this segment of Interstate Route 25 another 7.7 miles southward to the St. Charles River.

Actually, the Pueblo Expressway has been ten years in the building. It was projected directly after World War II when the postwar flood of traffic began clotting the downtown streets of Colorado's steel capital. But road-building budgets were cramped and the Freeway made only creeping progress until passage of the Federal-Aid Highway Act of 1956 gave the state roads budget the necessary fiscal transfusion.

Pueblo, lying at the confluence of the Arkansas and Fountain rivers where they spill down out of the towering Rockies, has watched the colorful cavalcade of American history pass its door. Lieutenant Zebulon Pike camped there only a few weeks before he discovered and gave his name to Pike's Peak.

Today, Pueblo is a thriving mile-high metropolis, home of the Nike missile and boasting the largest steel mill west of the Mississippi. It lies athwart the principal north-south travel artery on the eastern slope of the Continental Divide and the Pueblo Freeway has been designated as a segment of Interstate Route 25 which skirts the foothills all the way from Wyoming to New Mexico.

With a sharp eye for paring costs, the highway planners designed the pavement to take full advantage of asphalt stage construction. To the present three inches of asphalt concrete surfacing will be added another two inches at some future date.

Present design cross-section shows full-width, curb-to-curb pavement structure 21 inches in thickness: fourteen inches of subbase and four inches of granular base beneath three inches of asphalt concrete wearing surface. The 24-foot-wide travel lanes are flanked by inside and outside paved shoulders, four feet and ten feet wide respectively. Total cost of the pavement structure was $2.25 per square yard, based on bid tabulations for the latter-day projects.

Estimated cost of the two additional inches of asphalt concrete has been put at 85 cents per square yard, bringing the ultimate total cost of the pavement to $3.10 per square yard.

By employing modern asphalt paving with the added benefit of stage construction, the State of Colorado has planned wisely, spent prudently, and assured the users of this critical important north-south artery of an expressway pavement that can be paid for by this generation and enjoyed by the next.

The Pueblo Expressway—like similar asphalt-paved freeways cutting through the center of Boston, New York, Richmond and other major metropolises—is further testimony to the fact that highway planners can exploit the economy of asphalt paving for urban arteries and belt highways.

ID HANDSOME"

ASPHALT—PAVED EXPRESSWAY
FOR COLORADO STEEL CITY

Fourth Summer ASPHALT Course Held at Cornell

Cornell University conducted the fourth annual summer seminar in asphalt technology supported by a grant from The Asphalt Institute. The six-week course for engineering school instructors and researchers was attended by twenty students, sixteen of them recipients of grants-in-aid. Headed by Professor Taylor D. Lewis, the faculty was furnished by the College of Engineering and eight visiting lecturers.

The program was divided into three parts: design and analysis of airfield and highway asphalt pavements, laboratory studies in asphalt technology, and a seminar on transportation engineering. Field trips to a nearby asphalt mix plant, rock quarry and refinery rounded out the program.

The group, shown ranged on the steps of Hollister Hall in the usual left-to-right and top-to-bottom order, included: Messrs. Leikun, Hibbs, Dalton, Santucci, Clifford, Reyhner and Driscoll; Lamothe, Collett, Baker, Lewis, Roll and Straub; Smith, Claus, LaPrade, Heagler, Kemler, Pistrang and Taylor. In the foreground is the seminary faculty group: Associate Professor William Hewitt, Professor Lewis and Associate Professor George Lyon.

Most of West Germany's postwar autobahns are being paved with heavy-duty asphalt instead of concrete slab

Germa

DOLLAR for dollar and mile for mile, West Germany has bitten off an even more ambitious road program than the United States.

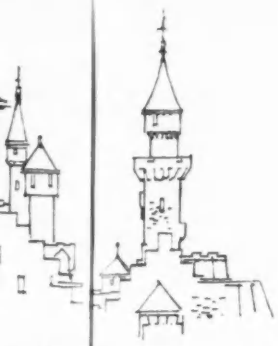
A couple of years ago we launched our original 13-year multi-billion-dollar campaign to complete a 41,000-mile Interstate network and overhaul thousands of miles of primary roads. The Germans have chimed in with their own 12-year $15.5 billion scheme to add 1,000 miles of new autobahns, resurface nearly half of the existing system, and rehabilitate some 7,000 miles of primary highways.

In cost and scope, the German road program is second only to the American effort—and, like ourselves, the Germans are feeling the financial squeeze.

But West Germany is wringing full value out of every dollar spent on its gargantuan project. Asphalt paving (including asphalt base) is the backbone of the program.

The modern German autobahn employs a gravel-asphalt base

The base is seven inches of hot-mix laid in three courses



Hitler's famed superhighways have become crazy-quilts of shattered and spalling slabs that are being broken up for use as asphalt pavement base

many turns to Asphalt

. . . for her new Autobahns

The Germans are pretty well disillusioned with their slab pavements. Of the 1300 miles of steel-reinforced concrete autobahns built between 1934 and 1940, about forty percent are in various stages of galloping disintegration. The spalled and fractured slabs are being broken up for foundation stone and resurfaced with thick asphalt concrete blankets.

Meanwhile, most of the new autobahn mileage (being added at a rate of about seventy miles a year) specifies full asphalt design—right down to, and including, hot-mix asphalt base. Typical is the new section of autobahn being built between Frankfurt and Wurzburg. The design cross-section shows a foundation frost blanket of sandy gravel ranging in depth from 16 to 27.5 inches and six inches of treated subbase.

Then comes seven inches of hot-mixed gravel asphalt base course laid in two or three layers. A 3.3-inch binder course is put down in two layers and topped off with a 1.4-inch mastic asphalt surface course or 1.6 inches of asphalt concrete. The mastic asphalt course contains about 25 percent limestone dust, 45 percent crushed stone and 6.5-7.0 percent or 35-50 or 50-70 penetration petroleum asphalt with an addition of about one percent of Trinidad lake asphalt. The balance is composed of pit sand.

MOTOR-DRIVEN PAVING TRAIN

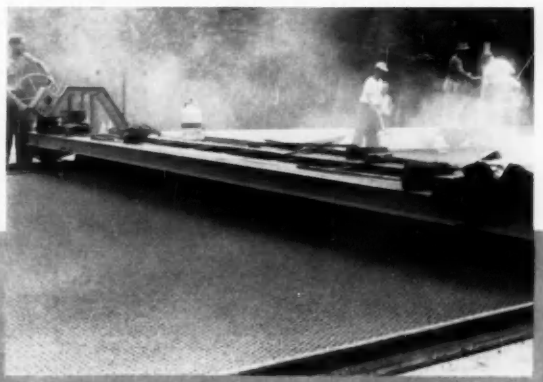
The mastic mix is spread at a temperature of 410-428 degrees F. by special pavers with adjustable propane heated screeds. Then the hot surface is covered with light asphalt-coated stone chips and riffled with a spiked roller which leaves a waffle pattern in the pavement. The paver, chip spreader and roller are motor driven and operate on rails as a single unit.

Until a year ago it was common practice to replace cracked and spalling concrete pavements on the autobahn network with new slabs. But this has proved very costly and futile. It was found that, in most cases, the new slabs were cracking in a few years.

So, in 1958 the Ministry of Transport published specifica-

The asphalt base is topped with a 3.3-inch binder course

Spiking produces waffle weave in 1.4-inch surface course



tions for rehabilitating the worn-out autobahns with asphalt paving. In some instances the old slabs are shattered by drop hammer and used as a subbase for the new asphalt pavement. In other cases, the old slab is removed entirely and new pavement is built from the foundation up as an asphalt structure.

When the shattered slab is recompacted and used as a foundation for the new pavement it is surfaced with 10-12 inches of hot-mix as follows:

1" asphalt leveling course
4-6" hot-mixed gravel asphalt or asphalt penetrated macadam in two or three layers
3" asphalt binder course in two layers
1.4-1.6" mastic asphalt or asphalt concrete surface

Germany's blooming love affair with asphalt bases was born out of a critical need to make maximum use of locally available aggregates. When the first small trial stretches showed the advantages of this type of construction, its popularity spread like a prairie fire. Last year about five million square yards of asphalt bases were laid on all types of German roads.

ADVANTAGES OF ASPHALT BASE

The advantages were immediately obvious. When compared with granular bases of the same thickness, asphalt bases reduced considerably the traffic stresses imposed on the subgrade and required no protection from frost. Also, it was found that asphalt bases need not be as thick as granular bases, reducing the design thickness of the pavement structure. Another important economic feature was the fact that locally available materials otherwise unsuitable for use in granular bases could be exploited in asphalt base mixtures. Further, experience showed it was neither necessary nor even desirable to draw up close grading limits since these could prove needlessly restrictive in making full use of local materials.

Construction delays were kept to a minimum since asphalt bases can be laid quickly by machine and immediately after the first layer is compacted it furnishes a weather-tight seal for the subbase. Further, an asphalt base can be opened to traffic for a year or more before placing the surface courses, permitting settlement and consolidation in the supporting courses. The German engineers also recognize that asphalt water-proofed bases will prevent weakening of the courses by accumulations of capillary moisture and water vapor.

ASPHALT BASE FOR SLABS

Even the new concrete pavements in West Germany are being placed on a four-inch hot-mix asphalt base, which is an interesting switch on the common United States design that reverses the procedure.

Germany's intense preoccupation with sturdier base construction is matched by her engineers' growing concern for greater compactive effort, particularly in the subgrade. It is an interesting coincidence that, at the same time in the United States, The Asphalt Institute is urging greater attention to compaction, drainage and asphalt base construction for modern heavy-duty roads.

Thus does the technology of asphalt paving advance steadily along a broad front.

(The article on Italy's new "Sun Highway" in the July issue of the Quarterly prompted so many inquiries about the electronic paving controls used in that country that a further discussion of this unusual feature seemed indicated. The device described below is manufactured by the Pizzarotti firm in Parma. A somewhat similar control instrument is reported to be under study by at least one major American manufacturer of paving equipment—The Editor.)

THE SEEING EYE

Italian paving is on the beam

MOST state specifications call for the use of a ten-foot straight-edge in testing the smoothness of a finished asphalt pavement.

Let's consider the possibilities if it were practical to construct and use a 100-foot straight-edge! Or 300-foot! Obviously, if applied to most new pavements, such an instrument would disclose erratic deviations from ideal gradient.

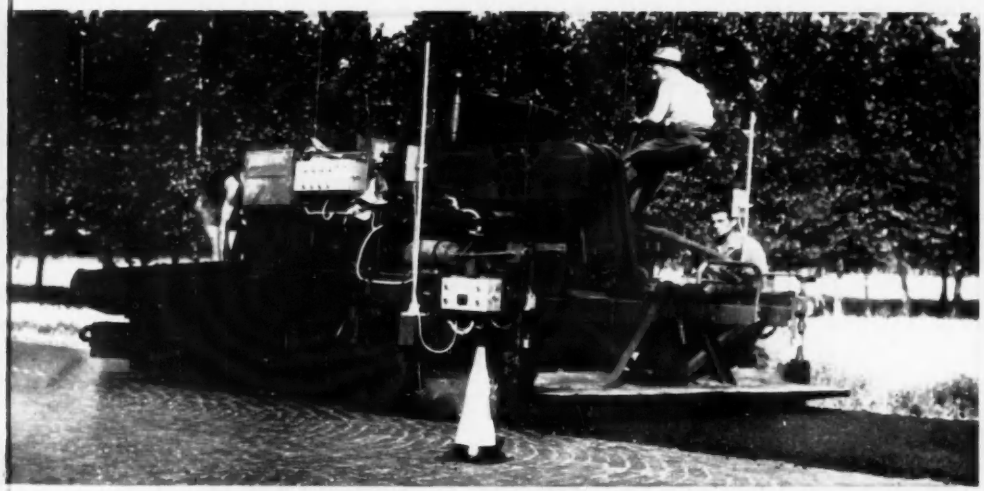
In effect, an Italian firm has developed just such a straight-edge. By employing the principle of the electronic eye, they have made it possible to maintain a steady longitudinal gradient over indefinite distances.

THE EYES HAVE IT

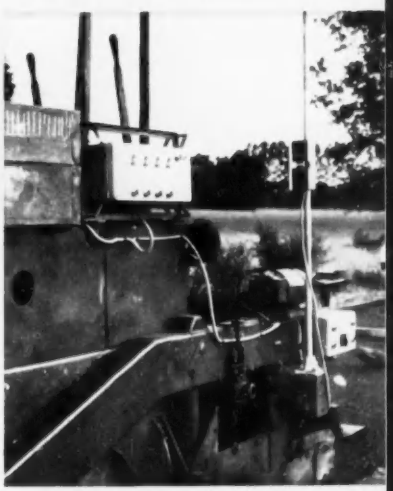
In simplest terms, this is done by setting up a pair of optical instruments at a distance of about 100-150 yards from the finisher with their collimation axis parallel to the steady gradient. Corresponding instruments are installed on the finisher itself and when the "eye" strays off the axis, correction is made instantaneously in the thickness controls, bringing the optical instrument back on the beam.

Thus, the finisher is made to adjust automatically to vertical irregularities over a considerable distance. By extending this theoretical gradient, the longitudinal profile of the finished pavement can approximately maintain the ideal straight line.

Excellent results have been obtained in Italy, both in highway and airfield paving, with the use of this gradient control instrument. Tests using special mechanical oscillation measuring devices have shown an astonishing difference between surface construction by the same finishing machine, using and not using the leveling equipment. Pavements laid with the new instrument controls have produced, over a distance of sixty yards, surface irregularities no greater than those acceptable within the tolerances of the applied ten-foot straight edge.

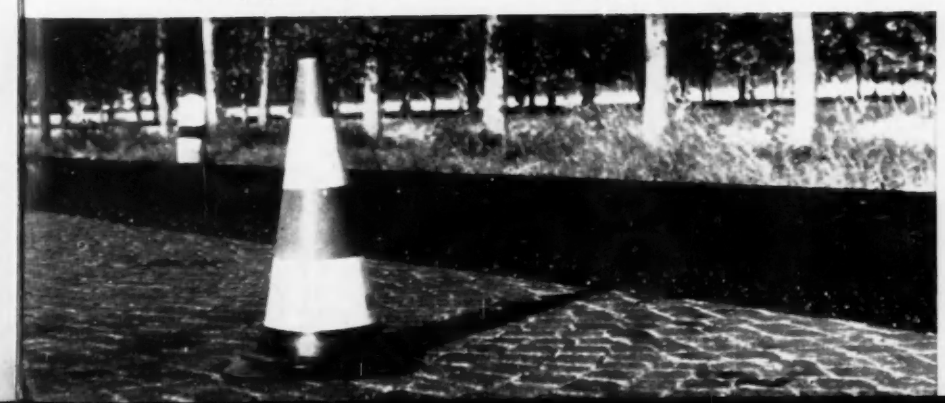


The electronic controls are mounted on each side of asphalt spreader



Close-up of control on spreader

Note varying thickness of the mat as machine adjusts to gradient



Showing the corrected gradeline

Surface smoothness has been measured to an accuracy of one-eighth of an inch in 110 yards.

IRONS OUT WRINKLES

Whether constructing a new pavement or resurfacing an old one, it is first necessary to establish the longitudinal profile. On this profile, acceptable gradients will be designed and the thickness of the asphalt mat determined at their extremities. Surface peaks must be identified and allowance made to assure that the minimum permissible thickness of asphalt blanket may be applied at those points.

Reports from Italy say experience has shown that very irregular levels can be reshaped with medium thicknesses of three to four inches, with a minimum of not less than 1.5 to two inches and a maximum running about six to nine inches.

Further tests have demonstrated the increased safety of the smoother pavement. The vehicles' wheels adhere to the surface, giving greater vehicle stability and resistance to skidding when the brakes are applied suddenly at high speed. In addition, such a pavement offers greater driving comfort with a lowering of the fatigue factor, in itself an important safety factor.

Memo to Engineers

INSTITUTE URGES ADOPTION OF

ADVANCED ASPHALT BASE DESIGN DRAINAGE CRITERIA COMPACTION

After studying the performance records of modern heavy-duty asphalt pavements and evaluating the data furnished by recent critical pavement tests, Asphalt Institute engineers have proposed "Advanced Design Criteria" for asphalt pavements. Virtually all asphalt pavement distress can be traced directly to three basic design failures:

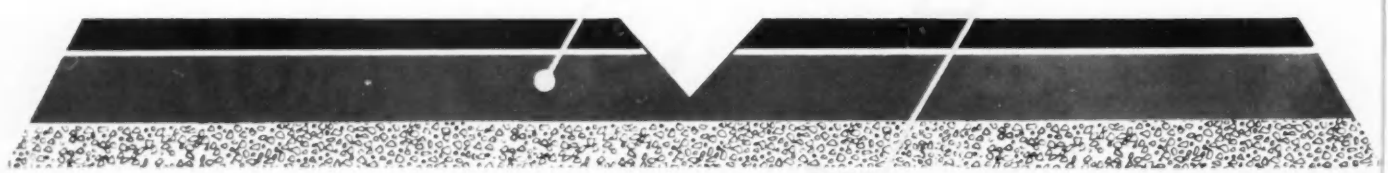
1. Inadequate thickness of the asphalt section
2. Faulty drainage
3. Insufficient compaction in one or all courses

To support the loads and stresses imposed by modern heavy wheeled traffic with rising contact pressures, the Institute is urging the adoption of asphalt bases and a minimum thickness of four inches in the binder and surfaces courses. The thicker asphalt section will give greater pavement strength where this added strength is needed, and will safeguard the pavement against the destructive forces of capillary moisture and trapped water vapor.

Similarly, improved full-width drainage for four-, six- and eight-lane divided highways (with depressed median drains) will relieve this hydrostatic pressure, reduce the danger of frost damage, and minimize the erosion of foundation materials.

Meanwhile, the channelized pattern of traffic imposed by today's heavier vehicles has demonstrated the need for more intensive compaction during construction. These tighter compaction specifications should apply to all courses, from the foundation to the asphalt concrete wearing course. When tire contact pressures of 100 pounds per square inch are applied to a pavement compacted at lesser pressures it must logically follow that additional compaction under traffic will result. This will lead inevitably to rutting and, in time, to longitudinal cracking of the pavement with intrusion of surface water, followed by the usual destructive chain of events.

The attention of design and paving engineers is called to the article on the extension of the German autobahn system in this issue (Page 10). Clearly, the German highway engineers, traveling their own empirical route, have reached the same conclusions.



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(As of October 1, 1959)

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